

A NEW OPERATIVE METHOD IN THE TREATMENT OF FRACTURE OF THE PATELLA.¹

By GEORGE RYERSON FOWLER, M.D.,

OF BROOKLYN,

SURGEON TO THE METHODIST EPISCOPAL AND TO ST. MARY'S HOSPITALS.

PERMIT me to premise this paper by a statement to the effect that, notwithstanding surgeons have apparently grown timid when the subject of the operative treatment of fracture of the patella is brought forward for discussion, in my judgment this is the only rational course to pursue, with certain exceptions, thereafter stating my reasons for offering to the victims of this injury the radical cure rather than the employment of tentative measures, which, in the vast majority of cases, give but indifferent results.

While I am fully aware that those who oppose the operation hold a valuable weapon in the shape of certain statistics of the operative treatment, still I think that, in a measure such as this, in which so much benefit is to be derived when the case is brought to a successful termination, the surgeon's individual experience should be, to some extent, his guide in determining whether or not he shall abandon a procedure for which no adequate substitute has been offered. If his own experience prove unfavorable, it is far preferable that he attempt to improve upon present methods than to revert to ancient ones, the employment of which, save in cases so extremely exceptional that it is scarcely worth while to take them into account, is followed by but indifferent results, so far as the function of the limb is concerned.

A few years ago every fracture of the patella occurring in the practice of surgeons in the large cities was in danger of being

¹ Read before the New York Surgical Society, February 13, 1895.

wired as a primary procedure. What with suppurative conditions resulting in loss of function of the joint, consequent amputation and loss of life from sepsis, the summary of results as derived from statistics, it must be confessed, made a very bad showing for the operation. Then came the reaction; the pendulum swung as completely in the other direction, and surgeons with mechanical instincts are as busily engaged as ever in devising appliances for the non-operative treatment of fracture of the patella.

To my mind, the question as to the causes of failure of union by bone and the substitution therefor of a ligamentous connecting band in fracture of the patella is practically settled. They are the same as exist when failure of union occurs after fracture of other bones,—*i.e.*, failure of approximation of the fragments, the interposition of soft parts, and the supervention of diseased conditions of the bone itself. In transverse fracture of the patella the first of these conditions is necessarily present, and the second is absent only in those cases in which the injury is the result of direct violence from striking against some hard resisting substance, the floor of the prepatellar bursa being driven sharply against the bone and its fibrous aponeurotic structures divided by the impact.

The first injury of this kind that came under my observation was that of a woman, who, in a fit of temporary insanity, threw herself from a third-story window to the ground. She suffered a compound comminuted fracture of the patella, the fragments of which came into apposition without difficulty, the bony surfaces making firm contact. The second case was one of double fracture (both patellæ), and resulted from a fall from a height of twenty-five feet, the patient falling squarely upon both bent knees. Although the fractures were not compound, as one might expect, yet they were comminuted, and the surrounding parts were very much contused. Upon opening the joint (for this was in the early days of wiring the patella, and the indications and contraindications relating to the operative procedure were not accurately defined) the fragments were brought into apposition without the necessity of removal of intervening tissue. A third case was one

in which the injury was the result of a kick from a vicious animal. In all of these cases the joint was opened, possibly, needlessly, as I now view it, but the experience has been valuable in that it decided me, in a fourth case of the kind coming under my observation, to refrain from operative interference. The result obtained, as well as an incident in the subsequent history of the case, may warrant its introduction at this point.

On September 5, 1890, W. V., aged twenty-two years, house-painter by occupation, was precipitated by the giving way of a scaffolding upon which he was working, from beneath the eaves of a three-story storage building, equal in height to a four-story dwelling, to the ground. In the descent both knees came in contact with a projecting window-ledge, and probably while the limbs were flexed. He was seen by me within an hour of the accident. Besides other injuries he was found to have a transverse fracture of each patella. The structures upon the anterior surface of the knee-joints showed evidences of having come in contact with some hard substance; both contusions and abrasions were present. The lines of fracture, in the case of both bones, were located somewhat nearer the middle of the bone than in the classical fracture. Upon careful palpation of the parts it was discovered that the fragments were about half an inch apart, but could be brought accurately in apposition, and also that, when the fractured surfaces were applied to each other, motion was not easily obtained, and when obtained, sharp, rasping crepitus was heard and felt. The inference drawn from this state of affairs was that the fractures were the result of direct violence, and that no intervening fibrous-tissue shreds were present between the fragments to prevent bony union. It was deemed possible to obtain the latter, providing the fragments could be maintained in proper position. With this in view, a plaster-of-Paris splint, fenestrated at the anterior knee portion, was applied. The fragments were adjusted through the fenestrum of each splint and held in position by proper-sized and tightly-rolled gauze rolls secured by adhesive plaster. At the end of four weeks, union having taken place, all apparatus was discarded, and massage of the quadriceps extensor femoris of each limb instituted. This was continued for a period of three weeks longer, at the end of which time, first passive and then active movements (the limb being guarded by a posterior check apparatus) were practised. *Complete*

restoration of function and indubitable bony union in both patellæ resulted.

On October 6, 1891, just thirteen months following the first, this patient met with the following accident: While standing upon the curb-stone and reaching for the step of his wagon with his left foot he missed the step, and, in attempting to save himself from falling, he felt something give way in the left limb, which at once became useless. He was taken to his home, where I saw him shortly afterwards. The usual appearances of transverse fracture of the patella were present. The line of separation corresponded to about the middle of the bone. The fragments were separated about two fingers' width, and when brought together no real crepitus could be obtained, although the fragments were apparently brought in contact. The sliding movements of the fragments upon each other were free and unimpeded. This injury, unlike the first, was the result of muscular effort, in this instance the fibrous aponeurotic structures forming the floor of the prepatellar bursa had not parted simultaneously with the bone, but an appreciable interval of time had elapsed between the occurrences, during which the fibrous tissue became stretched beyond its limits of resiliency, finally giving way. With the occurrence of the latter the portion which had bridged over the gap in the bone, by atmospheric pressure combined with tilting of the fragments, became entangled in the shape of irregular shreddy masses upon the spiculated fractured surfaces (Macewen). The presence of these prevented the occurrence of distinct crepitus and likewise permitted the rather free movements of the fractured surfaces upon each other.

The treatment instituted was precisely the same as in the first injury, the patient, in view of the favorable termination of the latter, declining operative interference. In spite of every care in securing and maintaining, apposition of the fragments the result was such as is commonly obtained in fracture of the patella treated by non-operative methods,—namely, ligamentous union.

The assertion that the overstretched and finally ruptured patellar aponeurosis plays the same rôle here as do the interposition of the soft parts between the fragments in ununited fractures elsewhere (for a fractured patella with non-osseous union is, in reality, an ununited fracture) is borne out both by analogy and clinical experience. In upward of thirty cases in which I have

inspected the interior of knee-joints following transverse fracture of the patella, in only those instances in which the fracture occurred from direct violence was this condition absent. Any method of treatment, therefore, in which this is not taken into account, the injury having been received in the usual manner,—*i.e.*, by muscular contraction,—will result, in the vast majority of cases, in failure of bony union,—in other words, these cases will terminate as ununited fractures. The possible exceptions to this rule are instances in which the floor of the prepatellar bursa is exceptionally thin and still further attenuated by the stretching process to which it is subjected, the fractured surfaces being left sufficiently free for the medullary tissue cells, or so-called osteoblasts, to gain access and obtain support.

The third factor in preventing union of a fracture in this region—namely, diseased conditions of the bone itself—is of very rare occurrence except as it may follow attempts to apply the wire suture or some of its modifications. Here the additional injury to the bone, resulting from the drilling and the presence of and pressure from the wire, combined with increased risks of infection when this method is employed, lead to caries of the bone.

A perfect functional result is certainly greatly to be desired following fracture of the patella, as well as all injuries, and it has been the glory of modern surgery that it has been able to restore to lives of usefulness many who, in the old times, were either condemned to perish or doomed to drag out a miserable existence as cripples or invalids. To obtain such a result it is essential that the same steps be taken here as in the case of fractures of the long bones,—*i.e.*, that the fragments be brought into accurate apposition with no intervening structures to prevent them from uniting. In order to effect the removal of the shreds of fibrous tissue it will be necessary to open the joint and clear the fractured surfaces by means of the knife, heavy scissors, or the sharp spoon. This being accomplished, the problem of how to secure the fragments in their proper relation to each other is presented. The bone suture first suggested itself for this purpose as the most rational procedure, a wire of silver being employed. While

many of the cases thus operated upon have given brilliant results, yet it is equally true that some have lost the use of the knee-joint partially or entirely, others have suffered amputation of the limb, while not a few have lost their lives. Septic synovitis is responsible for the result in cases in which extensive adhesions within the joint lead to fibrous ankylosis; suppurative osteo-arthritis, all the joint structures becoming involved, the surrounding soft parts finally taking part in the destructive processes, leads to amputation, with its attending dangers; finally, the occurrence of general infection, either from one of the above sources, or from extensive suppuration in the thigh, the infection finding its way from the upper recess of the joint capsule, which, according to Riedel, is frequently ruptured in this injury, may lead to the loss of the patient's life.

Briefly and plainly speaking, therefore, either it must be acknowledged that modern surgery is incompetent to deal radically with this class of injuries, or else its methods must be revised to meet the indications in a radical manner. The struggle must be that of vital resistance against infection,—of asepsis against sepsis.

It will be generally admitted that in a recent injury the tissues which lie in the immediate neighborhood are more or less impaired in their function through circulatory disturbances and extravasations, and hence are deprived to some extent of their power of vital resistance. To open a knee-joint through such structures is to invite septic processes from the very moment these are divided. Therefore, it is a wise precaution to defer the operation until sufficient time has elapsed to permit these tissues to regain their normal condition. Clinical experience supports this theoretical view, as evidenced by the fact that operations undertaken as secondary measures are far less frequently followed by disaster than those in which the operation is resorted to as a primary procedure. A further indication for delay resides in the assertion made by Riedel that the occurrence of rupture of the capsule at its upper recess (beneath the quadriceps extensor tendon) is an occasional complication of fracture of the patella, and that opening the joint before this rupture has healed may lead to

extensive infection of the intermuscular connective-tissue planes of the thigh.

Inasmuch as the skin over the patella in most individuals is peculiarly thick and marked with deep creases that are exceedingly difficult to cleanse thoroughly, the time occupied in waiting for the disappearance of disturbances of the soft parts, extravasations, etc., can be advantageously utilized in accomplishing an aseptic condition of the region of the knee-joint by repeated cleansings, and the continuous application of some non-irritant yet efficient antiseptic.

Having established a sufficient justification for the operation, and decided upon a proper time for its performance, a word as to the technique in general may be in order.

In speaking of the operation in a general way, it may be said that it should be conducted in all its details as a strictly aseptic procedure; the cavity of the joint should be exposed, and its structures handled as little as possible; the dissection for the purpose of exposing the fragments kept within the narrowest limits; the time occupied by the operation reduced to the minimum; no foreign body should be left in the joint; the fragments should be held in approximation by means employed from without rather than passing a suture through the fragments (wiring), or around the fragments (tiring); and, lastly, the wound should be closed without drainage, and the parts kept at rest by means of plaster of Paris.

The special method which I desire to bring forward for consideration consists essentially in exposing the fragments as an intermediate procedure, *i.e.*, after the immediate effects of the injury have subsided and before the occurrence of ligamentous union, for the purpose of clearing their surfaces of intervening soft parts, and the application of fixation-hooks somewhat resembling Malgaigne's, except that a single instead of a double pair is employed.

The parts are kept at rest for from fourteen to twenty-one days, or sufficiently long to permit of the subsidence of the effects of the traumatism upon the surrounding structures, as well as the closure of a possible rupture of the upper recess of the cap-

sule of the joint as described by Riedel. During this period of waiting, the time is advantageously occupied by daily cleansings of the parts with soap and water, and the application of gauze compresses wetted with the boro-salicylic solution of Thiersch, secured in position with a figure-of-eight bandage. The latter also serves to promote coaptation of the fragments.

The operation wound by which access is gained to the fracture is placed either transversely or vertically; if the former is employed it commences at the inner edge of the patella slightly above its middle, curves sufficiently downward to include beneath the flap the line of fracture, crosses the front of the lower fragment just above the attachment of the ligamentum patellæ, and ascends to terminate at a point opposite to the place of commencement. The half-moon-shaped flap thus marked out is dissected back just far enough to expose the line of fracture and no farther. Careful and systematic removal from between the fragments of the intervening mass consisting of stretched and torn shreds of fibrous tissue and partially organized blood-clot is now practised. This is greatly facilitated by first incising along the free margin of each fractured surface and loosening the mass at these points first. The blade is now slipped between the mass and the fractured surfaces, and the former freed from the latter without difficulty, and removed as one piece. Care is taken during this portion of the operation not to tilt or otherwise disturb the fragments, and to expose the joint surfaces as little as possible. No irrigating fluid should be employed; whatever portions of the *débris*, blood-clot, etc., which may chance to fall into the gap between the fragments, and cannot be picked out by the dressing forceps, may be removed with bits of sterilized gauze grasped between the blades of hæmostatic forceps.

The fragments are now made to approximate each other as much as possible. One of the fixation-hooks is thrust into the bone at the site of the attachment of the ligamentum patellæ to the lower fragment. The other is pushed through the skin and into the bone at the site of the attachment of the rectus femoris to its upper border. With the fractured surfaces in perfect coaptation, as seen with the flap still turned back, the shanks

of the fixation-hooks are drawn together and secured, and the fragments held in a most secure manner. Two or three very fine silk sutures may be employed to secure the edges of the soft parts along the line of fracture. The flap is now replaced and sutured with a continuous subcuticular silk suture. Sterile gauze dressings and non-absorbent cotton, secured in position by rollers, are applied; a plaster-of-Paris splint insures immobilization. If the cover of the transverse incision is properly managed the lower hook will be so placed as to secure the bone directly in the line of the incision, thus avoiding the passage of the former through a wound of its own in the skin. If the vertical incision is employed, both upper and lower hooks can be secured in the bone in the line of the incision. The transverse incision (U-shaped) gives better access to the parts, if well curved.

The fixation-hooks are permitted to remain for about three weeks. Should it become necessary for any reason to remove them earlier, this can be done by opening the splint at the anterior knee portion. The patient may recline, or sit, or go about in a wheel-chair during the convalescence.

The advantages claimed for this method are as follows:

(1) The parts to be operated upon are in better condition, both as regards vital resistance and asepsis than when the primary operation is done.

(2) There is the minimal exposure of the joint surfaces and disturbance of the fragments.

(3) The operation can be done in a remarkably short space of time, hence less risk is taken both as to sepsis and the anæsthetic.

(4) No foreign suture material is left in the bone to produce caries, or to demand subsequent reopening of the wound and removal.

(5) The hooks may be removed, and if the union is not found to be complete or firm, they may be reapplied.

Although I have carried out the details of the operation as above described, with the exception that I have applied the silver wire suture instead of the fixation-hooks in a sufficient number

of cases, to demonstrate the advantages of waiting until the tissues have regained their normal conditions before interfering, as compared with primary operations, but one case has come under my care since I devised the complete method conjoined with the use of the hooks. In this case the patient, a young female, received her injuries while descending the stairs in one of the large shopping emporiums in this city. She was taken at first to one of the metropolitan hospitals, and subsequently removed to her home in Brooklyn in a carriage. The operation was done on the twentieth day after the injury. The hooks being removed, the union was found to be perfect, and the very slightest amount of irritation conceivable had followed their presence.

Further, I would say that the employment of special fixation-hooks of the pattern used by myself is not necessary. Any of the single modifications of Malgaigne's hooks will answer. I selected this particular pattern for the reason that, by elevating the shanks, ample room was obtained for closing the wound, and for the application of dressings, which could not be readily accomplished by the ordinary Malgaigne's hooks. Finally, in cases in which the fragments come together easily the hooks may be dispensed with entirely, providing all tissue intervening between the fragments have been removed, coaptation being secured by any of the efficient methods employed in the non-operative treatment of transverse fracture of the patella.